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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/943,955	08/31/2001	Arulkumar P. Shanmugasundram	5918/04/FPS/MMCS/APC/DV	2623

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EXAMINER	
UMEZ ERONINI, LYNETTE T	
ART UNIT	**PAPER NUMBER**
1765	

DATE MAILED: 01/31/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/943,955	SHANMUGASUNDRAM ET AL.	
	Examiner	Art Unit	
	Lynette T. Umez-Eronini	1765	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *03 November 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-27 and 34* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-17,21-24 and 34* is/are rejected.

7)☒ Claim(s) *18-20 and 25-27* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *31 August 2001* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *8/11/2005*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

This communication is in response to Applicants' Remarks in Amendment (filed 11/3/2005), which were persuasive in showing the combination of the Campbell et al. (US 6,230,069 B1) in view of Adams et al. (US 5,664,990) failed to teach a model for wafer polishing that defines a plurality of substantially annular regions on a wafer and identifies a wafer material removal rate in a polishing step for each of the regions, as recited in claims 1 and 34. Hence, a new Office Action is presented using art that was cited in a previous Office Action.

Claim Rejections - 35 USC § 112

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claims 2-17 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In claim 2, line 7, "the post-polished"; and

In claim 34, line 5, :the effect of the tool state" lacks antecedent basis.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

4. Claims 1-17, 21-24 and 34 are rejected under 35 U.S.C. 102(b) as being anticipated by Wiswesser et al. (US 6,159,073).

Wiswesser discloses, ". . . a method of measuring a characteristic of a layer on a substrate during chemical mechanical polishing. . . " (column 2, lines 42-44). The method comprises using a series of polishing stations to effectively polish substrates (column 4, line 53- column 5, line 13).

Wiswesser also discloses " . . . A radial position is determined for each sampling zone, and the intensity measurements are divided into a plurality of radial ranges according to the radial positions. The characteristic is computed for each radial range from the intensity measurements associated with that radial range" (column 2, lines 54-59).

"Implementation of the invention may include one or more of the following features. The characteristic may be a polishing rate, . . . A measure of polishing uniformity may be calculated from the measured characteristic in each radial range. A model function, such as a sinusoidal function, may be determined for each radial range. The sinusoidal function may be described by a period and a phase offset, in which may

be computed from a least square fit of the model function to the intensity measurements in the associated radial" (column 2, line 60 – column 3, line 4).

". . . The thickness of a substrate layer on a blank wafer may be measured in-situ at a plurality of radial positions in order to generate a measure of the polishing uniformity to characterize the effectiveness of the CMP tool and process" (column 3, line 63 – column 4, line 1). The thickness measurements may also be performed when polishing a device wafer to detect the polishing endpoint.

Wiswesser further discloses ". . . Computer **48** may be programmed to . . . store intensity measurement from the detector, to display the intensity measurement on an output device **49**, to calculate the initial thickness, polishing rate, amount removed and remaining thickness from the intensity measurements . . ." (column 7, lines 1-9) and the " . . . if the in situ thickness measurement indicates that the center of the substrate is under polished, the pressure applied to the carrier head to the center of the substrate may be increased to improve polishing uniformity" (column 13, lines 37-44).

The aforementioned reads on,

A method of producing a target wafer thickness profile in a polishing operation, comprising:

a) providing a model for a wafer polishing that defines a plurality of substantially annular regions on a wafer and identifies a wafer material removal rate in a polishing step for each of the regions, wherein the model is based on measurements of one or more wafers that have completed the polishing step; and

(b) polishing a wafer using a polishing recipe based on the model that generates a target thickness profile for each region, **in claims 1 and 14-17**.

A method of controlling surface non-uniformity of a wafer in a polishing operation, comprising:

a) providing a model for a wafer polishing that defines a plurality of regions on a wafer and a plurality of polishing steps and identifies a wafer material removal rate in a polishing step of a polishing process for each of the regions;

b) polishing a wafer using a first polishing recipe;

c) determining a wafer thickness profile for the post-polished wafer of step (b); and

d) calculating an updated polishing model based upon the wafer thickness profile of step (c) and the model of step (a) and updating the first polishing recipe based on the updated model to maintain a target wafer thickness profile, **in claims 2-13**; and

A method of determining a model for wafer thickness profile, comprising:

(a) measuring pre-polished wafer thickness in a region defined on one or more wafers;

(b) polishing the one or more wafers, wherein polishing comprises polishing the one or more wafers in a plurality of polishing steps;

(c) measuring the wafer material removal rate for the one or more wafers after each of the polishing steps of step (b);

(d) providing a model defining the effect of tool state on polishing effectiveness; and

(e) recording the pre-polished and post-polished wafer thicknesses on a recordable medium, **in claims 21-24**; and

A method of producing a target wafer thickness profile in a polishing operation, comprising:

a) providing a model for a wafer polishing that identifies a region on a wafer, identifies a wafer material removal rate in a polishing step, and defines the effect of the tool state on polishing effectiveness; and

(b) polishing a wafer using a polishing recipe based on the model that generates a target thickness profile for each region, **in claim 34**.

Allowable Subject Matter

5. Claims 18-20, and 25-27 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

6. The following is a statement of reasons for the indication of allowable subject matter:

As to claims 18-20, the prior art of record taken alone or in combination fails to suggest, teach, or render obvious a method of producing a target wafer thickness profile in a polishing operation, wherein the wafer removal for a region j (AR'_j) in the model of step (a) is determined according to the equation as recited in claim 18, and in combination with the rest of the limitations of the said claims.

As to claims 25-27, the prior art of record taken alone or in combination fails to suggest, teach, or render obvious a method of determining a model for wafer thickness profile comprising: wherein the wafer removal for a region *j* (AR'_j) in the model of step (a) is determined according to the equation as recited in claim 25 and in combination with the rest of the limitations of the said claims.

Response to Arguments

7. Applicants' arguments, see Remarks, filed 11/3/2005, with respect to the rejection(s) of claim(s) 1-17, 21-24, and 34 27 and 34 under 35 U.S.C. §103(a) over Campbell US 6,230,069 B1) in view of Adams (US 5,664, 990) have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of Wiswesser (US 6,159,073).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lynette T. Umez-Eronini whose telephone number is 571-272-1470. The examiner is normally unavailable on the First Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on 571-272-1465. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Art Unit 1765

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January 19, 2006

EXAMINER